Chemistry - Central Science

CH. 3 Problems

26.b) % H in $HC_6H_7O_6$

$$\frac{8.064\text{ g H}}{176.12\text{ g}} \times 100 = \boxed{4.579\%\text{ H}}$$

$8 \times 1.008 = 8.064$
$6 \times 12.01 = 72.06$
$6 \times 16.00 = 96.00$
176.124 g
176.12 g

27.b) $C_8H_8O_3$

$$\frac{96.08\text{ g C}}{152.16\text{ g}} \times 100 = \boxed{63.14\%\text{ C}}$$

$8 \times 12.01 = 96.08$
$8 \times 1.01 = 8.08$
$3 \times 16.00 = 48.00$
152.16 g

28.b) CH_4O

$$\frac{12.01\text{ g C}}{32.05\text{ g}} \times 100 = \boxed{37.47\text{ g C}}$$

12.01
4.04
16.00
32.05 g

31.) .50 mol $H_2O \rightarrow$ 1½ mol <u>atoms</u>
23 g Na = 1 mol Na → 1 mol atoms
6.0×10^{23} molecules N_2 = 1 mol N_2
2 mol atoms

$$\boxed{Na < H_2O < N_2}$$

38.b)
$$\frac{6.955\text{ g }(NH_4)_2CO_3}{1} \times \frac{1\text{ mol }(NH_4)_2CO_3}{96.11\text{ g }(NH_4)_2CO_3} \times \frac{2\text{ mol }NH_4^+}{1\text{ mol }(NH_4)_2CO_3} =$$

$$\boxed{.1447\text{ mol }NH_4^+}$$

45.c)
$$\frac{40.0\text{ g C}}{1} \times \frac{1\text{ mol C}}{12.01\text{ g}} = \frac{3.33}{3.33} = 1$$
$$\frac{6.7\text{ g H}}{1} \times \frac{1\text{ mol H}}{1.01\text{ g}} = \frac{6.63}{3.33} = 2$$
$$\frac{53.3\text{ g O}}{1} \times \frac{1\text{ mol O}}{16.00\text{ g}} = \frac{3.33}{3.33} = 1$$

$$\boxed{CH_2O}$$

52b) $C_2H_4O \longrightarrow$

$2 \times 12.01 = 24.02$
$4 \times 1.01 = 4.04$
16.00
empirical mass → 44.06 g

$$\frac{88.0}{44.06} = 2$$

$$\boxed{\begin{array}{c} C_4H_8O_2 \\ \text{molecular} \\ \text{formula} \end{array}}$$

65.) $Al_2S_3 + 6H_2O \rightarrow 2Al(OH)_3 + 3H_2S$

$$\frac{14.2\text{g } Al_2S_3}{1} \times \frac{1 \text{ mol } Al_2S_3}{150.14\text{g}} \times \frac{2 \text{ mol } Al(OH)_3}{1 \text{mol } Al_2S_3} \times \frac{78.01\text{g}}{1 \text{ mol } Al(OH)_3} = \boxed{14.8\text{g } Al(OH)_3}$$

67.) at the end!

75.) a. $C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$

b. C_2H_5OH is LR

c. 1 molecule O_2 left over
4 molecules CO_2 produced
6 molecules H_2O produced
0 molecules C_2H_5OH remain

79.) $$3\overset{\frac{1.00\text{g}}{84.01\text{g}}}{NaHCO_3}{}_{(aq)} + \overset{\frac{1.00\text{g}}{192.14\text{g}}}{H_3C_6H_5O_7}{}_{(aq)} \rightarrow 3CO_2{}_{(g)} + 3H_2O_{(l)} + Na_3C_6H_5O_7{}_{(aq)}$$

I	.0119	.00520	0	0	0
C	−.0119	−.00397	+.0119	+.0119	+.00397
E	0	.00123	.0119	.0119	.00397

a) $NaHCO_3$ is LR

b) $$\frac{.0119 \text{ mol } CO_2}{1} \times \frac{44.01 \text{ g}}{1 \text{ mol } CO_2} = \boxed{.524 \text{ g } CO_2}$$

c) $$\frac{.00123 \text{ mol } H_3C_6H_5O_7}{1} \times \frac{192.14\text{g}}{1 \text{mol}} = \boxed{.236\text{g } H_3C_6H_5O_7}$$

	$\frac{30.0g}{78.12g}$	$\frac{65.0g}{159.80g}$		
83.) R	C_6H_6 +	$Br_2 \rightarrow$	C_6H_5Br +	HBr
I	.384	.407	0	0
C	−.384	−.384	+.384	+.384
E	0	.023	.384	.384

Theoretical Yield

$$\frac{.384\text{ mol } C_6H_5Br}{1} \times \frac{157.01g}{1\text{ mol } C_6H_5Br} = \boxed{60.3g\ C_6H_5Br}$$

$$\%\text{ Yield} = \frac{42.3}{60.3} \times 100 = 70.1\%$$

85.) $$\frac{30.0g\ H_2S}{1} \times \frac{1\text{ mol } H_2S}{34.08g} \times \frac{1\text{ mol } S_8}{8\text{ mol } H_2S} \times \frac{256.48g}{1\text{ mol } S_8} = 28.2\ g\ S_8$$

$$\frac{50.0g\ O_2}{1} \times \frac{1\text{ mole } O_2}{32.00g} \times \frac{1\text{ mol } S_8}{4\text{ mol } O_2} \times \frac{256.48g}{1\text{ mol } S_8} = 100.19g\ S_8$$

$1.00 \times 10^2 g\ S_8$

$$28.2g \times .98 = \boxed{27.6\ g\ S_8 \text{ actual yield}}$$

↓ Theoretical Yield

95.) $$\overset{1.05g}{C_xH_4O_2} + O_2 \rightarrow \overset{2.43g}{CO_2} + \overset{.50g}{H_2O}$$

$$\frac{2.43g\ CO_2}{1} \times \frac{1\text{ mol } CO_2}{44.01g} \times \frac{1\text{ mol C}}{1\text{ mol } CO_2} = \boxed{.0552\text{ mol C}} \times \frac{12.01g}{1\text{ mol C}} = .663g\ C$$

$$\frac{.50g\ H_2O}{1} \times \frac{1\text{ mol } H_2O}{18.02g\ H_2O} \times \frac{2\text{ mol H}}{1\text{ mol } H_2O} = \boxed{.0555\text{ mol H}} \times \frac{1.01g}{1\text{ mol H}} = .0561\ g\ H$$

$$\underset{\text{Sample}}{1.05g} - \underset{\text{C}}{.663g} - \underset{\text{H}}{.0561g} = .331g\ O \times \frac{1\text{ mol O}}{16.00g} = \boxed{.0207\text{ mol O}}$$

C : H : O

$$\frac{.0552}{.0207} : \frac{.0555}{.0207} : \frac{.0207}{.0207}$$

2.67 : 2.68 : 1 → ×3 → $C_8H_8O_3$

96.) i) $3.52\,g\,CO_2 \times \frac{1\,mol\,CO_2}{44.01\,g\,CO_2} \times \frac{1\,mol\,C}{1\,mol\,CO_2} \times \frac{12.01\,g\,C}{1\,mol\,C} = .961\,g\,C$

$\frac{.961\,g\,C}{1.50\,g\,Sample} \times 100 = \boxed{64.1\%\,C}$ in the sample!

ii) $1.27\,g\,AgCl \times \frac{1\,mol\,AgCl}{143.32\,g\,AgCl} \times \frac{1\,mol\,Cl}{1\,mol\,AgCl} \times \frac{35.45\,g\,Cl}{1\,mol\,Cl} = .314\,g\,Cl$

$\frac{.314\,g\,Cl}{1.00\,g\,Sample} \times 100 = \boxed{31.4\%\,Cl}$ in the sample!

iii) $\%H = 100\% - \underset{C}{64.1\%} - \underset{Cl}{31.4\%} = \boxed{4.5\%\,H}$

iv) $\frac{64.0\,g\,C}{1} \times \frac{1\,mol\,C}{12.01\,g} = \frac{5.329\,mol\,C}{.8858} = 6$

$\frac{31.4\,g\,Cl}{1} \times \frac{1\,mol\,Cl}{35.45\,g} = \frac{.8858\,mol\,Cl}{.8858} = 1$

$\frac{4.5\,g\,H}{1} \times \frac{1\,mol\,H}{1.01\,g} = \frac{4.455\,mol\,H}{.8858} = 5$

C_6H_5Cl

OR

i) $\frac{3.52\,g\,CO_2}{1} \times \frac{1\,mol\,CO_2}{44.01\,g\,CO_2} \times \frac{1\,mol\,C}{1\,mol\,CO_2} = $ .0800 mol C
.961 g C in a 1.50g Sample

ii) $\frac{1.27\,g\,AgCl}{1} \times \frac{1\,mol\,AgCl}{143.22\,g\,AgCl} \times \frac{1\,mol\,Cl}{1\,mol\,AgCl} \times \frac{35.45\,g\,Cl}{1\,mol\,Cl} = .314\,g\,Cl$ in a 1.00g Sample

$\frac{.314\,g\,Cl}{1.00\,g\,Sample} = \frac{x\,g\,Cl}{1.50\,g\,sample}$

x = .471 g Cl in a 1.50g Sample
.0133 mol Cl

iii) $\underset{}{\overset{Sample}{1.50\,g}} - \overset{C}{.961\,g} - \overset{Cl}{.471\,g}$
= .068g H
.067 mol H

iv) C : H : Cl

$\underset{6}{\frac{.0800}{.0133}} : \underset{5}{\frac{.067}{.0133}} : \underset{1}{\frac{.0133}{.0133}}$

C_6H_5Cl

67.) a. $$\frac{1.50 \text{ mol NaN}_3}{1} \times \frac{3 \text{ mol N}_2}{2 \text{ mol NaN}_3} = \boxed{2.25 \text{ mol N}_2}$$

b. $$\frac{10.0 \text{ g N}_2}{1} \times \frac{1 \text{ mol N}_2}{28.02 \text{ g N}_2} \times \frac{2 \text{ mol NaN}_3}{3 \text{ mol N}_2} \times \frac{65.02 \text{ g NaN}_3}{1 \text{ mol NaN}_3} = \boxed{15.5 \text{ g NaN}_3}$$

c. $$\frac{10.0 \text{ ft}^3 \text{ N}_2}{1} \times \frac{1728 \text{ in}^3}{1 \text{ ft}^3} \times \frac{16.4 \text{ cm}^3}{1 \text{ in}^3} \times \frac{1 \text{ mL}}{1 \text{ cm}^3} \times \frac{1 \text{ L}}{1000 \text{ mL}} \times \frac{1.25 \text{ g}}{1 \text{ L}}$$

$$= \boxed{354 \text{ g N}_2}$$

$$\frac{354 \text{ g N}_2}{1} \times \frac{1 \text{ mol N}_2}{28.01 \text{ g}} \times \frac{2 \text{ mol NaN}_3}{3 \text{ mol N}_2} \times \frac{65.02 \text{ g}}{1 \text{ mol NaN}_3} = \boxed{548 \text{ g NaN}_3}$$